Center for Integrative Coastal Observation, Research and Education

http://cicore.mlml.calstate.edu/

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The California State University
Center for Integrative Coastal Observation, Research and Education (CICORE)

I. Introduction

The California State University (CSU) led California **C**enter for **I**ntegrative **C**oastal **O**bservation, **R**esearch and **E**ducation (CICORE), an applied coastal research center, began its third year of operations 1 August 2004. CICORE (http://cicore.mlml.calstate.edu) is dedicated to producing nationally relevant solutions to the many challenges facing our marine and estuarine environments through the creation of a distributed coastal observatory that addresses economically and environmentally important challenges such as coastal erosion, watershed impacts, chemical contamination of food webs, depletion of fish stocks, toxic plankton blooms, marine-borne pathogens, and the rapid invasion of coastal and estuarine waters by non-indigenous species. The CICORE program's primary goals are to provide (i) timely and appropriate environmental data and analyses to scientists, agencies and the public for policy development and the evaluation of the effectiveness of coastal and environmental policy and (ii) near real-time publicly accessible internet-based products developed from the observatory sensors.

II. Year-Three Objectives

The long-term CICORE objectives remain:

1) Establish research and monitoring infrastructure covering from the 100 m isobath into and onto the shore, including estuaries, wetlands, and critical coastal habitats in California, for integration into national and global ocean monitoring efforts.
2) Conduct research on problems that affect the economic and environmental well-being of California.
3) Develop models for predicting change in coastal environments.
4) Enhance management capability of regulatory and resource management agencies for sustainable use of the coastal zone.
5) Enhance public awareness of the importance of coastal management.

Year three objectives:

CICORE's year three plan emphasizes: data serving, product development and serving, and integration with other programs to create a robust Regional Association focused on the coastal and watershed environment, and curriculum development. In other words, CICORE continues expansion with the inclusion of more CSU campuses, the development of new geospatial data streams, expansion of real-time and near real-time *in situ* data, and products derived from all these data sources. The goals can only be attained if CICORE partners with others to create vibrant California Regional Associations.

Specific goals include a) benthic mapping and characterization of fisheries habitats, potential Marine Life Protected Areas and the NSF funded Long Term Environmental Research site in Santa Barbara Channel, b) hyperspectral and multispectal imaging of the potential Marine Life Protected Areas, Tomalas Bay and Pt. Reyes, or the three California National Estuarine Research Reserves (NERR), c) continued expansion of the *in situ* sampling array and integration with non-CICORE sites and d) development of educational material related to the three observing technologies.

III. Achievements:

This reporting period is for the first half (1 August 2004 – 31 January 2005), of year three, the first year that the program has received a funding level which allows the program to pursue the long term goals with a system-wide approach.

Program Management:

The role of the CICORE Headquarters has become increasingly complex. With the initiation of Coastal Ocean Observing Systems Regional Associations (RAs), the CICORE program is now participating in the establishment of four developing regional associations SCCOOS, CeNCOOS, NANOOS and PaCOOS (Southern California Coastal Ocean Observing System, Central and Northern California Ocean Observing System, Northwest Association of Networked Ocean Observing Systems, and Pacific Coast Ocean Observing System). The communication and coordination with these RAs is extremely time intensive. A tag-team approach between Drs. Kamer, Garfield and Coale meets most of the organizational responsibilities with Dr. Garfield taking the lead. Dr. Kamer has consistently coordinated with CeNCOOS and all three have responded to queries from Congress, the CICORE partners and regional associations.

We started the year welcoming two new members, California State University Long Beach's Ocean Science Institute (CSULB OSI) and San Diego State University (SDSU), and elevating CSU Hayward (now CSU East Bay) to full membership status. CICORE presently has eight CSU members and two non-CSU members, Florida Environmental Research Institution (FERI) and Old Dominion University (ODU). The inclusion of CSULB and SDSU extends CICORE coverage into southern California and creates state-wide coastal coverage.

The other important CICORE expansion is the creation of a Presidents Board. In recognition of the importance of CICORE to the educational and research goals of the California State University system, the CSU Chancellor requested that a Presidents Board be created to help chart the development of the program within the CSU. President Rollin Richmond, Humboldt State University, is the chairman of the Presidents Board. The Board met twice during this reporting period; the inaugural meeting was held October 13, 2004. The second meeting of the Presidents Board, to discuss plans for CICORE year 4, was held January 25, 2005.

The CICORE Advisory Council met September 20, 2004. This meeting was important for the program because it allowed the first in depth evaluation of the program by this committee and the evaluation results were very important for the development of the CICORE year-4 proposal. The Advisory Council report, and the CICORE reply are appended as Appendix A and B.

Table 1. CICORE management-related meetings

August 20, 2004	CICORE PI meeting, CSUMB
September 20, 2004	CICORE Advisory Panel meeting, RTC
October 13, 2004	CICORE Presidents Board meeting, Long Beach, CA
November 16-17, 2004	COTS Workshop, Charleston, SC
January 25, 2005	CICORE Presidents Board meeting, Long Beach, CA

Integration

CICORE fully recognizes and supports the need to organize coastal observing systems in a nationally coherent strategy and supports the efforts by Ocean.US and NOAA Coastal Observation Technology Section (COTS) to implement the Integrated Ocean Observing System (IOOS) goals through the creation of IOOS Regional Associations. In California, two regional associations, CeNCOOS[1] and SCCOOS[2] are recognized as the emerging Regional Associations and have received both organizational and observational support from NOAA. CICORE has been involved with these two emerging RAs since their inception, particularly CeNCOOS.

Two of the five CeNCOOS interim executive council members are CICORE principal investigators. This group was formed to hire a CeNCOOS coordinator (accomplished December 2003) and provide advice until such time as an elected executive council can be assembled (slated for late 2005). In addition, CICORE investigators serve on all of the structured CeNCOOS subcommittees. To help with regional coordination efforts, CICORE plans to help support the CeNCOOS outreach coordinator when this position is established.

CICORE recognizes the importance of working with all Regional Associations and COTS funded observatories in the development of a "standardized" web presence to enable efficient browsing and product recovery by users. To facilitate this important access function, Dale Robinson, San Francisco State University (SFSU), has taken on the task of web coordinator and is a member of the COTS Common Interface Design Working Group which was organized at the November 17-18, 2004, COTS Workshop to develop guidelines for uniformity among IOOS web sites. Based on the work of this working group as well as interaction with CeNCOOS and SCCOOS, CICORE is about to unveil a new central web site.

Observatory Progress:

[1] http://cencoos.org/
[2] http://sccoos.org/

Each of the four campuses with *in situ* monitoring equipment, Humboldt, SFSU, MLML and Cal Poly SLO, continues to collect data and improve their ability to post the data on their respective web sites. SFSU completed the construction of a new pier on San Francisco Bay (Romberg Tiburon Center) and is moving monitoring equipment to the edge of the main channel between the Delta and the Golden Gate. CSU East Bay, CSULB and SDSU began purchasing new monitoring equipment to extend the monitoring array into southern California and South San Francisco Bay. It is anticipated that these equipment will be installed during the second half of this fiscal year. MLML continues testing a buoy for deployment in the Elkhorn Slough NERR.

Research:

- First high-resolution bathymetric survey of the entrance of the Golden Gate conducted since the 1950s.
- Hyperspectral imaging of 5460 km^2 at seven sites to bring the total area of hyperspectral imaging to 9775 km^2 of coastal and shallow water areas.
- Incorporation of a multispectral imager with four times greater spatial resolution with the hyperspectral imager.
- Development of a kelp coverage product and increased wetlands hyperspectral coverage.
- Expansion of *in situ* monitoring from four to six sites with the inclusion of South San Francisco Bay and Long Beach Harbor.

Seafloor Mapping Laboratory:

The seafloor mapping group continues to expand bathymetric mapping along the California Coast. A significant accomplishment is the first bathymetric survey of the entrance to the Golden Gate since the 1950s (Figure 1.). This survey, done in conjunction with the US Geologic Survey (USGS), was carried out to assist with a study of the wave regime and sediment movement at Ocean Beach, San Francisco. The new data reveal that dramatic changes have occurred at the SF Bay mouth since the last bathymetric survey conducted over 50 years ago. Upwards of 6 m of shoaling has occurred in the vicinity of the Army Corps of Engineers (COE) dredge spoil site, and new patterns in sand bar formation, seen for the first time in the bathymetry, explain the increased beach erosion. The tidal migration of massive dune fields at the bay mouth was also observed and quantified for the first time. These data are being used to develop and refine sediment transport and current models used by USGS and COE to maintain the SF Bay entrance channel, adopt new dredge spoil disposal strategies and create a beach replenishment program to halt further erosion of Ocean Beach.

In addition to the field surveys, the seafloor mapping group has continued development of its web portal for data access. Three different approaches to web accessible databases for serving raster, vector and point GIS data products have been implemented, evaluated and populated. A terabyte of seafloor mapping data is now available via two different servers:

ESRI ARCIMS server – http://seafloor.csumb.edu/arcims.htm
HTTP download site – http://seafloor.csumb.edu/SFMLwebDATA.htm

The ARCIMS site enables the user to access and view GIS data layers interactively from any web browser or to add content as view-only layers to an ArcGIS project on their local machine. Once the user has identified the content that they need using ARCIMS, they can then retrieve the data files or full ArcGIS projects to their local computer.

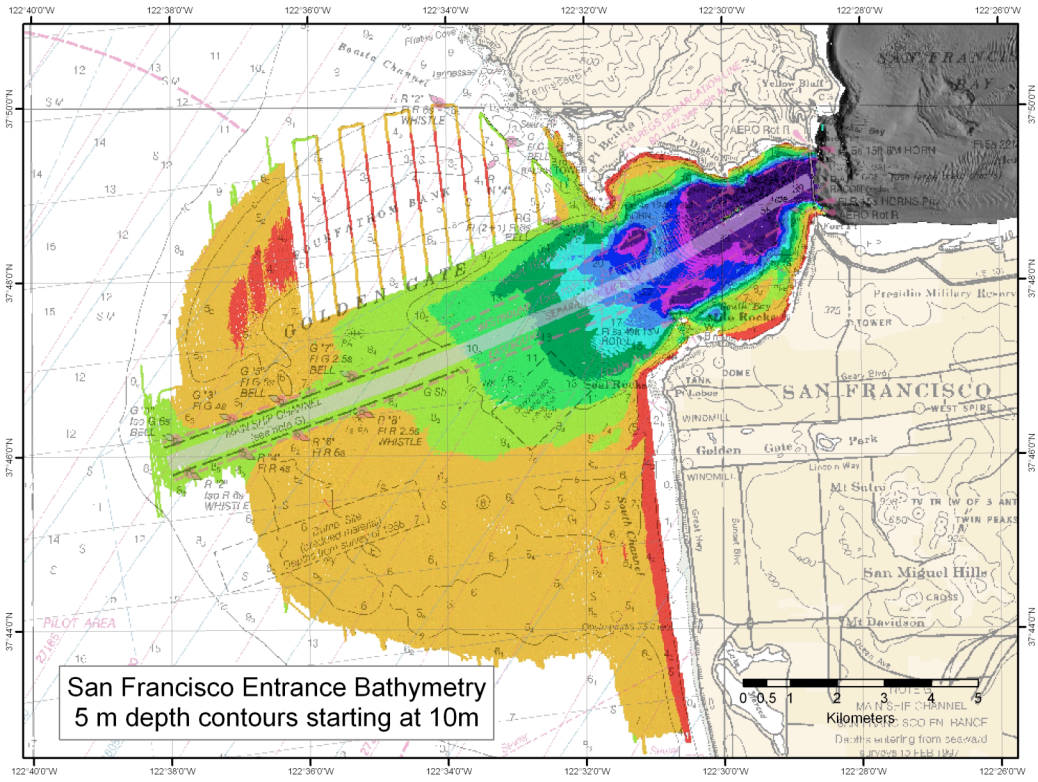

Figure 1. New multibeam bathymetry data for San Francisco Bay mouth being processed by CSUMB CICORE personnel and students for USGS and US Army Corps of Engineers. These results will be available on the CICORE on-line database.

Hyperspectral Imaging:

During October-November 2004 CICORE collected hyperspectral imagery (HSI) data over portions of the California coast between Humboldt Bay in the north and the Tijuana River Estuary in the south providing an unprecedented, unique coastal observation data set. A total of seven sites were imaged, covering an area of 5,460 km^2. This is a two-fold increase in coverage from previous years and brings the total HSI imagery to 9,775 km^2 of coverage. San Francisco Bay was imaged for the second time, and Monterey, Estero and San Luis Obispo Bays for the third time. The collect covered Humboldt Bay, all three California National Estuarine Research Reserves (NOAA NERR: San Francisco Bay, Elkhorn Slough and Tijuana Estuary), Morro Bay which is part of the National Estuary

Program, the Upper Newport Bay Ecological Reserve, the NSF-funded Long Term Ecological Research site (LTER) in Santa Barbara Channel and portions of the four NOAA National Marine Sanctuaries located in California waters (Cordell Bank, Gulf of the Farallones, Monterey Bay and Channel Islands). CICORE is building partnerships with all these programs through our HSI component and the products derived from these data.

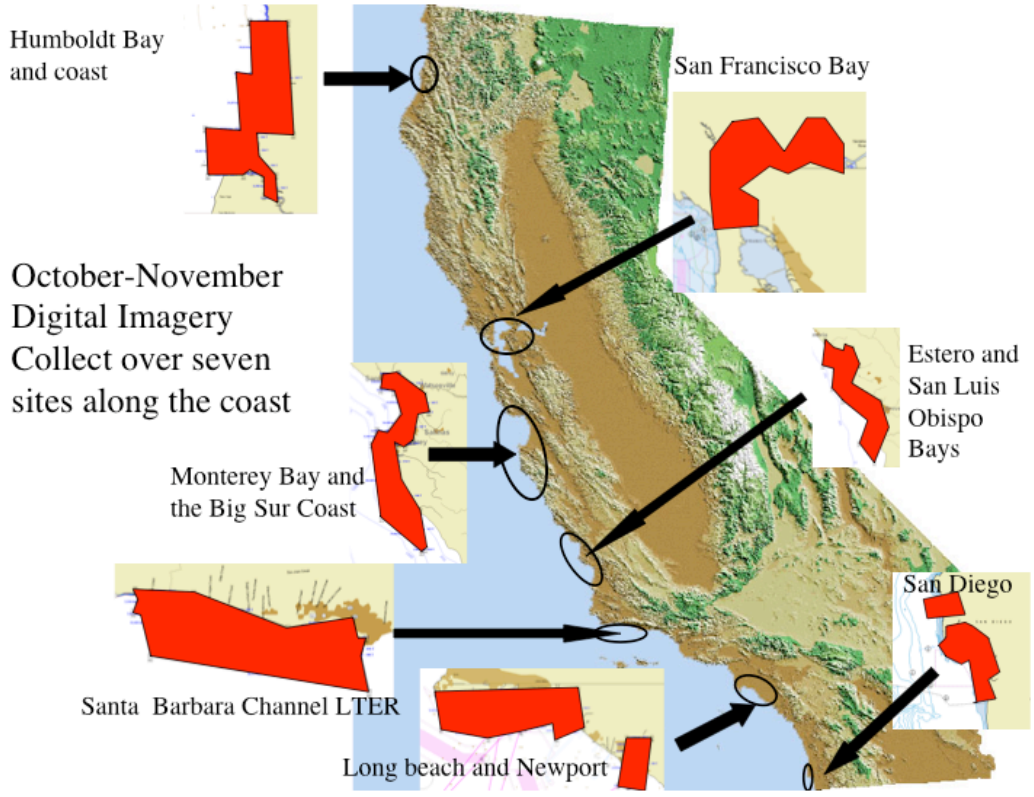

Figure 2. Map showing the seven sites and coverage obtained by the CICORE fall 2004 HSI field collect.

This was an extremely ambitious schedule involving the staging of both the aircraft crew and two sets of teams for ground truth support. FERI handled the logistics for the aircraft and HSI sensor and all partners contributed to the ground truth effort. ODU provided the lead and most of the personnel for the first team and the second team was assembled from personnel in the region being imaged. Stations were occupied in Humboldt Bay, San Francisco Bay, Monterey Bay, Carmel Bay, Estero Bay, off the Santa Barbara coast, Long Beach and San Diego Bay. By the end of the field collection efforts, all radiometrically calibrated measurements of water column inherent optical properties (absorption and attenuation), upwelling spectral radiance and attenuation, and above-water radiances were delivered to Dr. H. Dierssen for calculation of water leaving radiances. The water leaving radiances were provided to FERI by mid-December 2004 for use in atmospheric correcting of the HSI imagery. Filter pad samples were shipped to Dr. C. Trees (SDSU) for quantitative analysis of phytoplankton pigments.

During the San Diego Overflight, SDSU members, in collaboration with WETLabs Inc. also introduced the use of a towed package (WETLabs DOLPHIN) to measure vertical sections of inherent optical properties (IOP) [$a(\lambda)$, $c(\lambda)$ and $b_b(\lambda)$], multispectral RSR, CTD, and fluorescence between each "CICORE-standard" station. The first demonstration of this approach was accomplished using the SDSU research boat to survey San Diego Bay and off the Tijuana River NERR discharge area during the November 2004 HSI collect.

Note: CICORE worked with SatLantic[3] on the development of a new sensor, the Hyper Ocean Colour Radiometer (HyperOCR) designed to provide the apparent optical properties of the ocean surface needed as the ground truth measurements for the HSI data. SatLantic delivered the first two instruments to CICORE in August 2004 and held a training workshop before the beginning of the HSI field collect. The SDSU CICORE partners did extensive optical calibration of the instruments.

Table 2: CICORE web pages at the member institutions:

Moss Landing Marine Laboratories	http://cicore.mlml.calstate.edu
California Polytechnic State University, San Luis Obispo	http://www.marine.calpoly.edu/cicore/default.shtml
California State University, East Bay	http://www.sci.csuhayward.edu/cicore/
California State University, Monterey Bay	http://seafloor.csumb.edu/CICOREweb.html http://seafloor.csumb.edu/arcims.htm http://seafloor.csumb.edu/SFMLwebDATA.htm
Humboldt State University	http://cicore.humboldt.edu/
San Francisco State University	http://sfbeams.sfsu.edu
Florida Environmental Research Institute	http://www.flenvironmental.org/ http://www.flenvironmental.org/HyDroDB/login.asp

Education and Outreach:

CICORE's commitment to outreach and education continues to strengthen. Particularly exciting is that the *in situ* monitoring data collected north and south of Palos Verdes peninsula (CSULB) will be displayed in real time at the two local aquariums, Cabrillo Marine Aquarium and the Aquarium of the Pacific. CICORE students will be involved with providing public interpretation and training aquarium staff. This interaction will also lead to the involvement of grade and high school science teachers for curriculum development.

In addition, CICORE data are being used as training sets in a number of classes at member institutions and CICORE instruments are part of an instrument and methods class for meteorologists and oceanographers taught at SFSU.

CICORE works with many regional efforts on education. Besides bringing the data into the classroom, CICORE was a cosponsor of the San Francisco Bay National Estuarine

[3] http://www.satlantic.com

Research Reserve hosted workshop "The use of Geographic Information Systems (GIS) data for coastal decision makers," held August 11-12, 2004.

IV Summary:

CICORE is having a significant impact along the California coast and during this six month period made major advances to implement the articulated long term goals. We are establishing an array of in situ monitoring stations which compliment other in situ arrays and are obtaining critical baseline data in sensitive coastal environments.

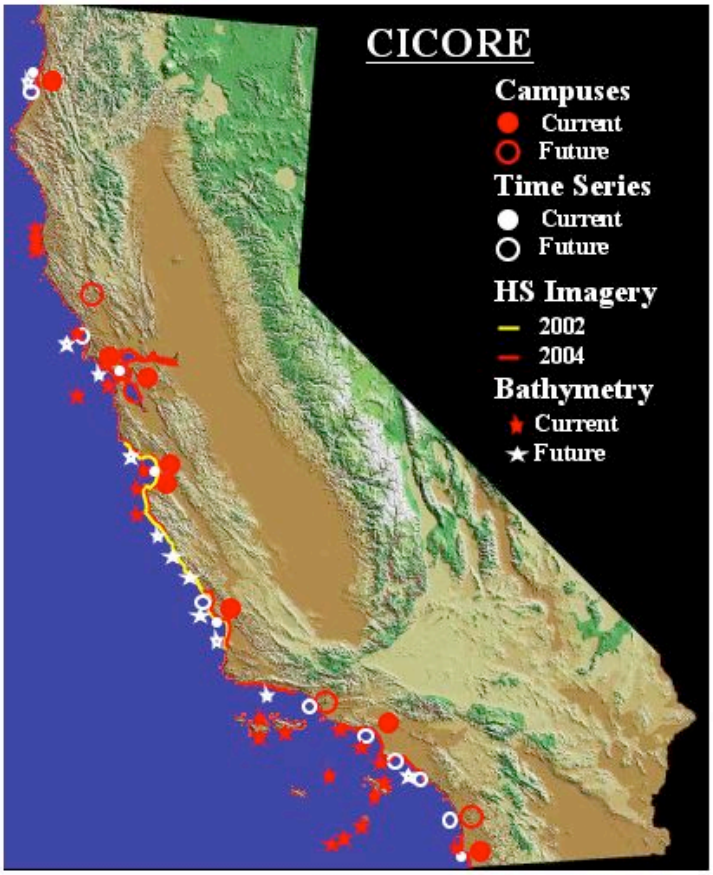

Figure 3: map of the CICORE presence along the California coast showing the location of partner campuses, in situ monitoring, HSI surveys and bathymetric surveys. Filled symbols show present members and sampling sites, open symbols show expansion members and sites.

The funding level this year is allowing the CICORE partners to begin coordination and integration of the three observing technologies into exciting and useful products and decision making aids. In addition, the synergy of this distributed observatory is now starting to expand into collaborations with other observatory efforts, state and local regulatory agencies and private industry.

Appendix 1:

CICORE Advisory Council

Written Comments following Meeting, 20 September 2004.

Attending: Laura Rogers-Bennett, Mario Tamburri, Andrew De Vogelaere, Steve Weisberg, Churchill Grimes, David Hull, Janet Campbell, John Largier.

Apologies: Bill Robberson, Stephanie Watson, Karen Worcester, Kim Taylor, Nicholas Papadakis

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General Comments.

The Advisory Council *commends CICORE* team on establishing a significant program that links together several CSU campuses. The initiation of such a program should not be underestimated. This program is already in operation and there are some early products, putting CICORE in the forefront of coastal ocean observing efforts in California. To-date CICORE has shown focus in identifying 3 primary themes and there are notable achievements in each of these. The CICORE team communicates an engaging vision in recognizing their unique opportunities in the spatial distribution of CSU campuses and in their role in education in California.

The Advisory Council suggests that after two years CICORE is at a *decision juncture* in terms of defining itself, accomplishing its goals, and sustaining itself. We expect to see the authorization of federally funded ocean observing systems within a few years. CICORE has an opportunity to capitalize on its strengths and develop a clear identity with the promise of notable impact. The pilot/organize phase is giving way to the research phase, in which specific focus and products need to be defined. Decisions on how best to define CICORE should be taken in light of the development of regional associations as vehicles for federal funding.

It is time for a *program review*, with a view to moving from earmark funding to funding through authorized federal programs in coastal ocean observing. Are the three original science/research themes the best choices that CICORE can make? Are they optimal, or are there other foci that would yield more product/impact? Will the existing themes sustain the program (i.e., attract ongoing funding support)? CICORE now has the experience to make hard choices on these 3 original themes.

Specific Topics.

Define who you are, and let that determine what you do.
As the national coastal ocean observing initiatives develop, CICORE needs to figure out what it is and how it fits into larger organizational structures (e.g., regional associations) – recognize that CICORE is part of a diverse and extensive landscape of OOS activities. Our expectation is that CeNCOOS and SCCOOS will develop into the regional associations for California and our opinion is that CICORE is not in a position to successfully challenge that. Given that view, CICORE has to find a way to integrate with others; specifically, how to become a key part of the developing regional associations or the national OOS action. We can see two options (and some of us favor the second one):

1. Provide a specialist service to the nation (cf. ACT and their focus on technologies). CICORE opportunities may lie in education services or in providing the much-needed technical workforce for OOS activities.
2. Develop activities and products that are an indispensable part of whatever regional associations or other organizational structures develop in California (SCCOOS, CeNCOOS, PACOS, NANOOS).

Either way, CICORE needs to develop and demonstrate uniqueness (e.g., build on and highlight your undergraduate educational programs). To do this, CICORE will need to be somewhat narrow in focus. Further, CICORE should develop a working map of links with other OOS entities so as to be clear on what relationships CICORE has with others, and (most importantly) what you want them to become. In particular, CICORE will need to address how it will be part of two regional associations at the same time. You will need to make hard choices in what CICORE does, but this will be necessary to ensure that CICORE is sustained in funding.

Our discussion was primarily directed at 3-5 year horizon, and how CICORE will evolve into sustained and key component of authorized OOS activities in the nation. We recognize that in the immediate future there are no funds for regional associations and that CICORE will need to continue to pursue earmark funding (and that different ideas and activities are attractive in this setting). This is a difficult balancing act.

Review of focus themes.
The Advisory Council did not have enough information to provide comment on specific activities to-date. While we are individually aware of successes, the presentation could have made a better case for these successes and their value in an OOS context. The answers to the following questions were not obvious to us:

- Why did you choose the 3 original foci? Are these choices and underlying reasons still valid? Are these choices optimal? Were they (are they still) the correct choices?
- What are the products? Is there someone (agency) who says "I need and will support that"?
- Who are your clients? Who will use the products and how? Who will write letters to Congress for you?

Opportunities.

The Advisory Council noted two possible opportunities for CICORE to define itself (and there are likely others). Both of these themes are already part of CICORE, but they do not shine through and do not provide an integrating role.

Land-ocean interface. Many ocean issues are located on the interface between land and sea (wetlands, estuaries, beaches, bays, nearshore, inner shelf). Most coastal OOS activity on the west coast is directed at open coastal waters ("shelf oceanography"). CSU campuses are typically well positioned for the land-ocean focus, with existing activities across this interface (in contrast with big ocean institutions). This theme can be built on aspects of the 3 existing investments. There are likely to be many products and clients – specifically, the state is charged with managing nearshore resources and could become a key client.

Education. CSU has a unique opportunity to target education aspects – both in terms of training and more broadly. There is much existing activity, and different strengths at different campuses. Through coordination and exchanges, this linking of CSU campuses can provide a great benefit and have a notable impact. Education activities can be integrated with operational systems, and instruction can be a mix of short-courses, certificate programs, semester courses, majors, and symposia. A CICORE education-PI would help develop this focus. We believe that this education and training focus would be very well received at both state and national levels. It is our expectation that CSU funds would join federal funds in direct support of this theme, and that would make this collaboration even more attractive to federal OOS initiatives.

Involving more campuses.

The Advisory Council recognizes the dangers of spreading too thin, but also sees the spatial extent of CSU as a unique opportunity. We suggest a tiered engagement of campuses. Involve as many campuses as possible in some activity that is affordable and practicable – e.g., temperature-salinity records, and curriculum development. Then, as funding allows, let each campus build on this – in the case of TS data, some may address harmful algal blooms, some may address fecal

bacteria contamination of swimming waters, and some may address fishery populations. These local interests will reflect local campus interest and local societal needs.

Continue to limit the number of significant members that are supported in specific projects. These specific proposal-driven projects need to be big enough to have impact not only as part of the network, but also as a stand-alone activity.

Hyperspectral work.

The Advisory Council was not convinced that hyperspectral digital data is an appropriate focus for CICORE. Our attention was drawn to this through the presentation. We are concerned that CICORE may be over-investing in this and of the opinion that CICORE should moderate this hyperspectral activity/budget/promise. Those activities that are pursued should be clearly related to products. In this sense, we are suggesting that CICORE evaluate this work in terms of costs and benefits. In discussion, a vision of education and geo-spatial technologies was suggested – this could provide cause, focus and vision for CICORE in which this hyperspectral work would be invaluable. This may be an identity around which CICORE could develop.

The hyperspectral activity came across as technology-driven and rather exclusive (only involving a limited number of campuses). In discussion, this perception was corrected. Unless CICORE identifies itself as a technology developer, this activity should become more question-driven and product-driven. Are promised products truly preferable to a resource manager (e.g., the kelp maps described)? How will CICORE "market" these new products?

Other funding sources.

It seems that CICORE is best served by remaining with a focus on NOAA. This is to avoid mixed messages and, more importantly, because it is expected that OOS funding is increasingly routed through NOAA.

CICORE could explore state funding sources and/or collaborations with state agencies. Specifically, this may be important in campus-specific or local themes.

Individual members of CICORE could gain from pursuing supplementary funds from defense, state and other sources.

Outreach.

While outreach does not appear to be a competitive advantage for CICORE, there are aspects of it that tie into the education focus and these should be pursued. Secondly, there is an opportunity for local outreach in the distributed nature of CSU campuses. Local researchers can best link with local agencies and communities (e.g.,

city, county, local NGO). These one-on-one connections are invaluable in a regional association.

Presenting CICORE.

Based on decisions on CICORE identity, you need to develop a clear way to articulate this and why it is important. By this time next year, the Advisory Council should leave the 1-day meeting with a much clearer idea of what defines CICORE and what its future role will be.

Advisory Council.

Advisory Council recommends that it is comprised of 12 people: marine resource managers (state & fed), regional associations, COTS partner, local government, NOAA CSC (ex officio), education expert, UCMC, science/tech/data expertise, NGO.

Appendix 2:

CICORE response to the Advisory Council Review

The CICORE program was reviewed by a panel of independent national experts from a wide range of disciplines. Three of these experts have observatory programs of their own, some are resource managers, some are with state agencies (see table). None were from the CSU, yet all recognized the impressive contribution CICORE has made towards the establishment of a distributed coastal observatory throughout California. It was interesting to note that one of the Advisory Council members directs a similar east coast COTS program, funded at the same level, yet these funds are distributed to a single university and the observational charge spans only eleven miles. CICORE involves over 10 institutions and spans over eleven hundred miles of coastline. This disparity was not lost on the Council.

For their time, their insights and their recommendations, the CICORE program is extremely grateful. We summarize below our response to some of these comments and include here some of the background to help evaluate the Council's comments and the ways in which CICORE and the CSU could take advantage of this evaluation to strengthen the program.

CICORE has been recognized by this group of experts as having firmly established itself in a nationally competitive research arena, and is to date one of the most productive for it's level of funding. This is a finding that provides strong justification to members and appropriators who have been skeptical of the capacity of the CSU to engage at such a high level towards the realization of the national IOOS goals. This finding will also be helpful in articulating the success of the CICORE program to other CSU partners and reviewers of the forthcoming proposals.

One of the critical elements of the review dealt with the three-platform approach to coastal observation upon which CICORE has established itself. In particular, the Council requested that the CICORE program reevaluate the hyperspectral overflights and challenged CICORE to identify more users for these data products. One recommendation was to conduct a cost/benefit analysis of this part of the program to determine whether it was worth the cost. The cost/benefit suggestion did not appear in the Council's report yet will become an exercise that CICORE will conduct prior to the next funding cycle.

For those unfamiliar with geospatial data, the hyperspectral approach provides a massive amount of data, is groundbreaking technology and is becoming one of the most valuable tools for habitat characterization. Still in the development stage, quite a bit of research and the development of GIS based habitat characterization/quantification tools have yet to be developed. Yet, CICORE is well positioned to lead this effort and develop data sets that can provide the basis of educational programs throughout many disciplines: Biology, environmental studies, geography, geology, etc… The two examples that CICORE had time to present dealt with a more accurate assessment of kelp forest canopies and the distribution of red tides, yet many other examples exist as well. It is expected that the

development of other data products will create a strong demand for these observational method. CICORE is developing the data sets that will be used by resource managers now and in the future.

The Advisory Council identified one strength of the program to be workforce related. It is recognized that not enough people are being trained in the emerging management technologies. The CSU is in a unique position to utilize the CICORE program as a training ground for those interested in geospatial analysis techniques, coastal observing technology, time series analysis, interpretation and resource management. To address this, CICORE should include an outreach component that could involve the development of curricula in the above listed areas, including instrumentation, both at the undergraduate and graduate levels. Although the COTS programs were neither designed, nor charged with the responsibility to serve an educational mission, the CSU is in a position to leverage the CICORE datasets and sampling efforts in this regard. Needed here would be a focus by CICORE investigators and other faculty within CSU campuses, to develop both outreach (K-12) and CSU curricula.

Another point made by the Advisory Council was their concern that the implementation of the CICORE program was being conducted by CSU faculty with other full-time responsibilities. Although some of the faculty have been successful at buying out their WTU assignments, many are not. Some consideration should be given to providing release time for faculty associated with this effort, especially during the developmental stages of this program.